Appendix B – Delta-Mendota Canal 2010 Water Quality Monitoring Program – Groundwater

RECLAMATION

Managing Water in the West

2010 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
South-Central California Area Office

Revised: 19 Feb 2010

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

List of Abbreviations and Acronyms

Authority	San Luis and Delta-Mendota Water Authority
ºC	degrees Celsius
DMC	Delta-Mendota Canal
DMC Headworks	DMC Milepost 2.5, Jones Pumping Plant
DMC Check 13	DMC Milepost 70, O'Neill Forebay
DMC Check 20	DMC Milepost 111, near Firebaugh
DMC Check 21	DMC Milepost 116, terminus at Mendota Pool
COC	chain of custody
CVP	Central Valley Project
DFG	California Department of Fish and Game
EC	electrical conductivity, µS/cm
Exchange Contractors	San Joaquin River Exchange Contractors Water Authority
ºF	degrees Fahrenheit
mg/L	milligrams per liter, equivalent to parts per million
QA	Quality Assurance
QC	Quality Control
QCO	Quality Control Officer
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
Regional Board	California EPA, Central Valley Regional Water Quality Board
TDS	Total dissolved solids, mg/L
USGS	U.S. Geological Survey
µg/L	micrograms per liter, equivalent to parts per billion
µS/cm	microSiemens per cm, salinity in water

2010 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan

Introduction

The overall supply of Central Valley Project (CVP) water has been reduced by drought and restrictions on pumping from the Sacramento-San Joaquin Delta. Under the Warren Act of 1911, Reclamation may execute temporary contracts to convey non-project water in the federal Delta-Mendota Canal (DMC) to farms to help sustain crops. Reclamation will also enter into exchange agreements in which groundwater pumped into the DMC will be exchanged with Reclamation for CVP water in San Luis Reservoir and delivered to from the San Luis Canal. In 2010, Reclamation will accept groundwater in the DMC subject to the monitoring and reporting requirements outlined in this document.

This document describes the plan for measuring the changes in the quality of water in the canal caused by the conveyance of groundwater during 2010, plus changes in groundwater elevation to estimate subsidence. Various agencies will use the data to determine the water quality conditions in the Delta-Mendota Canal, Mendota Pool, and wetlands water supply channels, and physical condition of local groundwater resources.

This document has been prepared by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation), in cooperation with the San Luis & Delta-Mendota Water Authority (Authority), and the San Joaquin River Exchange Contractors Water Authority (Exchange Contractors), with assistance from staff of Banta Carbona Irrigation District, Del Puerto Water District, San Luis Water District, and Panoche Water District.
This monitoring plan will be conducted by staff of Reclamation, the Authority, and Water Districts and will complement independent monitoring by other Federal, State, and private agencies.

Several sampling techniques will be used to collect samples of water, including real-time, grab, and composite. The techniques used at each location are summarized in Section 3.

Continuous measurement of specific conductance (salinity) will be recorded at four stations in the canal using sondes connected to digital data loggers. The data will be averaged every 15 minutes, sent via satellite to the California Data Exchange Center where it will be posted in the Internet as preliminary data:

http://cdec.water.ca.gov/queryDaily.html

Central Valley Operations Office will post the daily average salinity measurements on its website:

http://www.usbr.gov/mp/cvo/wqrpt.html

The real-time data will be collected by Reclamation and used in a mass balance to calculate and predict water quality conditions. The calculated results will be reported to various agencies, and compared with independent field measurements collected by the Reclamation, the Exchange Contractors, US Geological Survey, and California EPA Central Valley Regional Water Quality Control Board (Regional Board).

Reclamation will operate autosamplers at four locations along the DMC and Mendota Pool that will collect daily composite samples for measurement of selenium and salinity.

Reclamation and the Regional Board will collect grab samples from various locations in the watershed to measure many other parameters.

Reclamation will use the data to assess changes in water quality and groundwater conditions caused by the 2010 DMC Pump-in Program, and will implement the terms and conditions of the 2010 Warren Act Contracts, exchange agreements, and the 15 January 2010 Letter from the Exchange Contractors to Reclamation (Appendix A).

Background

The Delta Division of the federal Central Valley Project (CVP) delivers water to almost a million acres of farmland in the San Joaquin Valley of California. The CVP is also the sole source of clean water for state and federal wildlife refuges and many private wetlands in Fresno, Merced, San Joaquin, and Stanislaus Counties.

The source of water for the Division is delta of the Sacramento and San Joaquin Rivers. This water is suitable in quality for irrigation and wetlands. The region is regularly affected by droughts that reduce the supply of water for the region. Environmental regulations also restrict the operation of the Jones Pumping Plant to divert water from the delta into the DMC. The salinity of water in the Delta is highly variable due to the influence of tides and outflow of river water.

The Delta-Mendota Canal (DMC) carries CVP water to farms, communities, and wetlands between Tracy and Mendota. The 116 mile canal is operated and maintained by the Authority under contract with Reclamation. Inflows of tailwater and subsurface water add contaminants to the DMC.

Under normal conditions, Reclamation delivers approximately 3 million acre-feet of water within the Authority's service area. Of this amount, 2.5 million acre-feet are delivered to agricultural lands, 150,000 to 200,000 acre-feet for municipal and industrial uses, and between 250,000 to 300,000 acre-feet are delivered to wildlife refuges for habitat enhancement and restoration.

The districts and refuges in the Delta Division use groundwater to supplement their contractual supply from the CVP. Three Delta Division districts also have riparian rights to water in the San Joaquin River. These other supplies of water are called "Non-Project Water" because they have not been appropriated by the United States for the purposes of the CVP.

The Warren Act of 1911([1]) authorizes Reclamation to execute temporary contracts to impound, store, and carry water in federal irrigation canals when excess capacity is available. Reclamation will also execute exchange agreements per CVPIA[2] in which Reclamation exchanges CVP water in San Luis Reservoir delivered to districts on the San Luis Canal for groundwater pumped into the DMC. Such contracts and exchange agreements will be negotiated by Reclamation with Delta Division water districts to allow the introduction of non-project water into the DMC to supplement the diminished supply of CVP water. This has helped farmers deliver enough water to irrigate and sustain valuable permanent crops like grapes, citrus, and deciduous fruit, and to sustain the local multi-billion dollar farming economy.

The quality of local groundwater is variable and must be measured to confirm that there will be no harm to downstream water users when the non-project water is pumped into the canal. Reclamation has developed a set of standards for the acceptance of non-project water in the Delta-Mendota Canal based on the requirements of downstream water users.

In 2010, environmental regulations and climate change have reduced the supply of surface water for the Central Valley Project. Water managers now must depend on groundwater to supplement surface water for irrigation. However, continuous pumping of groundwater can quickly reduce local aquifers and can cause irreversible damage to facilities through subsidence.

In 2010, Reclamation will require more detailed information about each source of groundwater and more monitoring of the aquifer to measure overdraft, prevent subsidence, and determine the feasibility of continuing this program in the future. Staff from the Authority and water districts will be required to take regular measurements of depth to groundwater, pump rates, and in-stream salinity measurements.

This Monitoring Plan will ensure that monitoring data will measure any changes in the quality of CVP water in the DMC and Mendota Pool.

Monitoring Mission and Goals

The mission of this monitoring program is to produce physical measurements that will determine the changes in the quality of the water in canal caused by the conveyance of groundwater during 2010. The data will be used to implement the terms of the 2010 Warren Act Contracts and exchange agreements, and to ensure that the quality of CVP water is commensurate with the needs and expectations of water users.

The monitoring program will also deal with changes to groundwater resources to identify and prevent long-term problems to local aquifers and facilities.

[1] Act of February 21, 1911, ch. 141, 36 Stat. 925

[2] Section 3405(a) of the Central Valley Project Improvement Act (CVPIA) (Title 34 of Public Law 102-575)

Program Goals

The general goals of monitoring are:

- Evaluate the quality of water in each well, and

- Confirm that the blend of CVP water and groundwater is suitable for domestic, agricultural, and wetlands uses.

- Provide reliable data for regulation of the 2010 DMC Pump-in Program to prevent contamination problems

- Provide measurements of groundwater dynamics (depth, recharge) to identify overdraft and subsidence

Study Area

The Study Area for this program encompasses the Delta-Mendota Canal from Tracy to Mendota, and the Mendota Pool. The canal is divided into two reaches in relation to the O'Neill Forebay and the connection to the State Water Project.

Water Quality Standards

Non-project water must meet the standards listed in Tables 6 and 7. The lists have been developed by Reclamation to measure constituents of concern that would affect downstream water users. In particular, the concentration of selenium in any pump-in water shall not exceed 2 ug/L, the limit for the Grasslands wetlands water supply channels specified in the 1998 Basin Plan.[3] The salinity of each source of pump-in water shall not exceed 1500 mg/L TDS.

Water Quality Monitoring Plan

In-stream Monitoring

The quality of water in the DMC will be measured at the locations listed in Tables 1, 2, and 3.

Reclamation will operate and maintain the real-time stations listed in Table 1. Based on available funding, Reclamation will continue to collect water samples at the sites listed in Table 2 under the DMC Water Quality Monitoring Program. Reclamation will be responsible for the costs of sampling and analysis of water sampled from the DMC.

Table 3 is a list of places along the canal near clusters of wells that could pump into the canal under this program. If the real-time monitoring is not sufficient to identify in-stream changes in quality caused by the addition of groundwater, Reclamation may require weekly measurements at the checks listed in table 3 to determine local effects

[3] California Regional Water Quality Control Board, Central Valley Region, Fourth Edition of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins.

from groups of wells. For example, if the quantity of CVP water in the canal is limited, Reclamation will require detailed monitoring to identify the individual and cumulative changes in water quality caused by the addition of groundwater.

Table 1. Real-Time Monitoring Stations

Location	Operating Agency	Parameters	Frequency	Remarks
DMC Headworks	CVO	EC	Real-time	CDEC Site: DMC
DMC Milepost 70 (Check 13)	CVO	EC	Real-time	CDEC site : ONI
DMC Milepost 111.3 (Check 20)	CVO	EC	Real-time	CDEC site : DM2
DMC Milepost 116.5 (Check 21)	CVO	EC	Real-time	CDEC site : DM3

Key:
CDEC: California Data Exchange Center CVO: Central Valley Operations Office

Table 2. Water Quality Monitoring Stations

Location	Operating Agency	Parameters	Frequency	Remarks
DMC Milepost 3.46	Reclamation	EC, selenium	Daily composite	Autosampler
DMC Milepost 68 (McCabe Road)	Reclamation	Various	Monthly	Grab sample
DMC Milepost 70 (Check 13)	Reclamation	EC, selenium	Daily composite	Autosampler
DMC Milepost 97.7 (Russell Ave)	Reclamation	EC, selenium, boron, mercury	Monthly	Grab sample
DMC Milepost 110.1 (Washoe Ave)	Reclamation	EC, selenium, boron, mercury	Monthly	Grab sample
DMC Milepost 116.5 (Check 21)	Reclamation	EC, selenium	Daily composite	Autosampler
Mendota Pool (CCID Main Canal at Bass Ave)	Reclamation	EC, selenium	Daily composite	Autosampler

Key: Reclamation: MP-157 Environmental Monitoring Branch

Table 3. In-Stream Monitoring Stations (Optional)

Location	Responsible Agency	Parameters	Frequency	Remarks
DMC Milepost 16.2 (Check 2)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 20.6 (Check 3)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 34.4 (Check 6)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 38.7 (Check 7)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 48.6 (Check 9)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 64.0 (Check 12)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 85.1 (Check 16)	SLDMWA	EC	Weekly	Field measurement
DMC Milepost 100.9 (Telles Bridge)	SLDMWA	EC	Weekly	Field measurement

Key:
SLDMWA: San Luis and Delta-Mendota Water Authority

Wellhead Monitoring

Initial Analysis

All districts participating in the 2010 DMC Pump-in Program must provide the following information about each well to Reclamation prior to pumping groundwater into the DMC:

- the location of each well, pumping rate, and point of discharge in to the DMC;

- complete water quality analyses (Table 5 or 6)[4]

- the depth to groundwater in every well before pumping into the DMC commences.

The recommended summary forms for each well are included as Appendix 2.

Though most of the wells are privately owned, the Districts must provide access to each well for Reclamation and Authority staff.

All water samples must be sampled and preserved according to established protocols in correct containers. Analyses should be conducted by laboratories that have been approved by Reclamation, listed in Table 7. Each sample of well water must be sampled and analyzed at the expense of the well owner. Reclamation staff will review the analytical results and notify the District which wells may pump into the DMC in 2010.

[4] Note: Laboratory analyses of water in each well may be measured within three years

Compliance Monitoring

Daily Salinity

Mean daily salinity will be assessed with the sensors along the canal that report real-time data to CDEC, listed in Table 1. Such data will be downloaded by Reclamation and the Authority to monitor changes along the canal.

Weekly Monitoring

Reclamation may require weekly measurements of salinity along the DMC if the real-time sensors are not sufficient to identify changes. If necessary, Reclamation will direct the SLDMWA to measure the EC of water in the canal at the places listed in Table 3. These sites are located downstream from clusters of wells that could pump into the DMC. In addition, reclamation may also direct SLDMWA staff to measure the EC of the water in each active well

The weekly volume of groundwater pumped into the DMC from each well will be measured by the Authority and sent to Reclamation at the end of each week.

Selenium Monitoring

Reclamation will continue to measure selenium in the canal and Mendota Pool with autosamplers listed in Table 2. Reclamation may collect samples of water from various active wells; the cost of these tests will be borne by Reclamation. Based on available funds, Reclamation may also measure boron daily.

Depth to Groundwater

The Authority will continue to measure the depth to groundwater in each active well quarterly. Table 8 is a summary of measurements collected by the Authority between May 1995 and December 2009. The current depth to groundwater in each well will be compared to the depths listed in Table 8. If the current depth exceeds the maximum depth observed in table 8, then Reclamation direct the District to stop pumping from that well until the depth recovers to the median observed depth.

Data Compilation and Review

All compliance monitoring data collected by the Authority (i.e., flow, EC, and depth of groundwater from each active well, EC in the DMC) will be entered into worksheets and presented each week to Reclamation via e-mail. Reclamation will review the data to identify changes in the quality of water in the canal and in individual wells, and potential changes in the local aquifer that could lead to overdraft or subsidence.

Water Quality Monitoring Parameters and Data Management

The following sections describe the parameters for real-time and laboratory measurement of water quality, as well as methods for quality control, data management, and data reporting.

Real-Time Water Quality Monitoring Parameter

Reclamation and the Central Valley Operations Office have sensors along the DMC that measure salinity and temperature of water. These continuous measurements are posted on the Internet in real-time.

Salinity

Salinity is a measure of dissolved solids in water. It is the sum weight of many different elements within a given volume of water, reported in milligrams per liter (mg/L) or parts per million (ppm). Salinity is an ecological factor of considerable importance, influencing the types of organisms that live in a body of water. Also, salinity influences the kinds of plants and fish that will grow in a water body. Salinity can be estimated by measuring the electrical conductivity (EC) of the water.

Central Valley Operations Office (CVO) uses this conversion factor for estimating Total Dissolved Solids (TDS) from EC:

TDS (mg/L) = EC (µS/cm) * 0.618 + 16

Sampling For Laboratory Analyses of Water Quality

The following sections describe constituents for laboratory analyses of water quality, as well as methods for water quality sampling and chain of custody documentation.

Constituents

Table 5 and 6 are lists of constituents to be measured at in each well that will pump into the DMC during 2010. Parameters include selenium, mercury, boron, nutrients, and other compounds that cannot be measured with field sensors. Table 7 is a list of laboratories that have been approved by Reclamation.

Sampling methods

Grab samples will be collected in a bucket or bottle from the point of discharge into the canal. Samples of canal water should be collected mid-stream from a bridge or check structure. Grab samples should be poured directly into sample bottles appropriate to the analyses. This technique is for samples collected weekly or less frequently. Reclamation will specify the sample volume, type of bottle, need for preservative, and special handling requirements. Reclamation will train field staff on proper sample collection and handling.

Time composite samples will be collected by Reclamation using an autosampler. Daily composite samples will consist of up to eight subsamples taken per day and mixed into one sample. Weekly composite samples will consist of seven daily subsamples mixed into one sample.

Chain of Custody documentation

Chain of custody (COC) forms will be used to document sample collection, shipping, storage, preservation, and analysis. All individuals transferring and receiving samples will sign, date, and record the time on the COC that the samples are transferred.

Laboratory COC procedures are described in each laboratory's Quality Assurance Program Manual. Laboratories must receive the COC documentation submitted with each batch of samples and sign, date, and record the time the samples are transferred. Laboratories will also note any sample discrepancies (e.g., labeling, breakage). After generating the laboratory data report for the client, samples will be stored for a minimum of 30 days in a secured area prior to disposal.

Quality Control

Reclamation will assign staff to verify the accuracy of all measurements for this program.

Quality control (QC) is the overall system of technical activities that measure the attributes and performance of a process, item, or service against defined standards to verify that stated requirements are met.

Quality assurance (QA) is an integrated system of management activities involving, planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

QA objectives will be used to validate the data for this project. The data will be accepted, rejected, or qualified based on how sample results compare to established acceptance criteria.

The precision, accuracy, and contamination criteria will be used by the QCO to validate the data for this project. The criteria will be applied to the blind external duplicate/split, blank, reference, or spiked samples submitted with the production samples to the analytical laboratories by the participating agencies to provide an independent assessment of precision, accuracy, and contamination.

Laboratories analyze their own QC samples with the client’s samples. Laboratory QC samples, including laboratory fortified blanks, matrix spikes, duplicates, and method blanks, assess precision, accuracy, and contamination. Laboratory QC criteria are stated in the analytical methods or determined by each laboratory. Since internal control ranges are often updated in laboratories based on instrumentation, personnel, or other influences, it is the responsibility of the QCO to verify that these limits are well documented and appropriately updated during system audits. The preferred method of reporting the QC results is for the laboratory to provide a QC summary report with acceptance criteria for each QC parameter of interest.

For water samples, the QCO will use a statistical program to determine if current concentrations for parameters at given sites are consistent with the historical data at these

sites. A result is determined to be a historical outlier if it is greater than 3 standard deviations from the average value for the site. The presence of an outlier could indicate an error in the analytical process or a significant change in the environment.

Samples must be prepared, extracted, and analyzed within the recommended holding time for the parameter. Data may be qualified if the sample was analyzed after the holding time expires.

Completeness refers to the percentage of project data that must be successfully collected, validated, and reported to proceed with its intended use in making decisions.

Constraints with regard to time, money, safety, and personnel were some of the factors in choosing the most representative sites for this project. Monitoring sites have been selected by considering the physical, chemical, and biological boundaries that define the system under study.

Sites also were selected to be as representative of the system as possible. However, Reclamation will continue to evaluate the choice of the sites with respect to their representativeness and will make appropriate recommendations to the Contracting Officer given a belief or finding of inadequacy.

Comparability between each agency's data is enhanced through the use of Standard Operating Procedures that detail methods of collection and analysis. Each agency has chosen the best available protocol for the sampling and analyses for which it is responsible based on the agency's own expertise. Audits performed by the QCO will reinforce the methods and practices currently in place and serve to standardize techniques used by the agencies.

Data Management

This program will use data from several independent sources. Each collecting agency will be responsible for its data reduction (analysis), internal data quality control, data storage, and data retrieval.

Real-Time Data – Raw data from field sensors, must be identified as preliminary, subject to change

Provisional Data - Data that have been reviewed by the collecting agency but may be changed pending re-analyses or statistical review

Laboratory Data – Data produced by the laboratory following laboratory QA/QC protocols

Data Reporting

Preliminary data for each well must be compiled by each district and reported to Reclamation for review and approval. The list of approved wells will be included in the District's 2010 Warren Act contract.

In-stream data will be collected by Reclamation. Routine measurements of flow, EC, and depth of groundwater in each well will be collected by the Authority and sent to Reclamation each week.

Reclamation will compile these data in a water balance model developed by Reclamation, the Authority, and Exchange Contractors to predict the change in salinity in the canal with the addition of groundwater.

Real-time data will be used to monitor day-to-day patterns and assess actual conditions. The real-time data will be posted in regular e-mail messages to the districts and Authority. Reclamation will compile all flow, water quality, and groundwater data into a final report for future reference.

Data Interpretation

Reclamation staff will review all data for the canal and all wells pumping into the canal.

In accordance with the Exchange Contractor's letter of 15 January 2010, the addition of groundwater cannot cause an increase in salinity of more than 30 mg/L in the lower DMC, nor cause the in-stream salinity to exceed 450 mg/L.

Each week, Reclamation staff will use the real-time salinity measurements (Table 1) and optional weekly in-stream measurements (Table 3) to monitor and determine the changes in water quality caused by the conveyance of groundwater in the DMC.

Reclamation will direct the Authority and the Districts to stop pumping groundwater into the upper DMC if the concentration of these constituents in the canal exceed the maximum allowable concentrations listed in Table 4.

Table 4. Maximum Allowable Concentration of Seven Constituents in the Upper DMC

Constituent	Monitoring Location	Maximum concentration in the DMC
Arsenic	McCabe Road	10 µg/L
Boron	McCabe Road	0.7 mg/L
Nitrates as N	McCabe Road	45 mg/L
Selenium	Check 13	2 µg/L
Specific conductance (EC)	Check 13	1,200 µS/cm
Sulfates	McCabe Road	250 mg/L
Total Dissolved Solids*	Check 13	800 mg/L

*Calculation: TDS (mg/L) = EC (µS/cm) x 0.618 + 16

Reclamation will direct the Authority and the Districts to stop pumping groundwater into the lower DMC if:

- the additional groundwater is causing an increase of 30 mg/L in TDS between Check 13 and 20, or

- the TDS of water in the canal exceeds 450 mg/L, measured at Check 20[5].

Reclamation reserves the right to modify this monitoring program at any time to change.

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[5] Note: Reclamation will continue to monitor the effects of the six sumps near Firebaugh that pump subsurface groundwater into the canal.

Table 5. Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal Headworks to Check 13 (O'Neill Forebay)

Constituent	Units	Maximum Contaminant Level		Detection Limit for Reporting		CAS Registry Number	Recommended Analytical Method
Primary							
Aluminum	mg/L	1	(1)	0.05	(2)	7429-90-5	EPA 200.7
Antimony	mg/L	0.006	(1)	0.006	(2)	7440-36-0	EPA 200.8
Arsenic	mg/L	0.05	(1)	0.002	(2)	7440-38-2	EPA 200.8
Barium	mg/L	1	(1)	0.1	(2)	7440-39-3	EPA 200.7
Beryllium	mg/L	0.004	(1)	0.001	(2)	7440-41-7	EPA 200.7
Boron	mg/L	0.7	(16)			7440-42-8	EPA 200.7
Cadmium	mg/L	0.005	(1)	0.001	(2)	7440-43-9	EPA 200.7
Chromium (total)	mg/L	0.05	(1)	0.01	(2)	7440-47-3	EPA 200.7
Lead	mg/L	0.015	(9)	0.005	(8)	7439-92-1	EPA 200.8
Mercury (inorganic)	mg/L	0.002	(1)	0.001	(2)	7439-97-6	EPA 245.1
Nickel	mg/L	0.1	(1)	0.01	(2)	7440-02-0	EPA 200.7
Nitrates (as NO3)	mg/L	45	(1)	2	(2)	7727-37-9	EPA 300.1
Nitrate + Nitrite (sum as nitrogen)	mg/L	10	(1)				EPA 353.2
Nitrite (as nitrogen)	mg/L	1	(1)	0.4	(2)	14797-65-0	EPA 300.1
Selenium	mg/L	0.002	(13)			7782-49-2	EPA 200.8
Thallium	mg/L	0.002	(1)	0.001	(2)	7440-28-0	EPA 200.8
Secondary							
Chloride	mg/L	250	(7)			16887-00-6	EPA 300.1
Copper	mg/L	1	(10)	0.05	(8)	7440-50-8	EPA 200.7
Iron	mg/L	0.3	(6)			7439-89-6	EPA 200.7
Manganese	mg/L	0.05	(6)			7439-96-5	EPA 200.7
Molybdenum	mg/L	0.01	(11)			7439-98-7	EPA 200.7
Silver	mg/L	0.1	(6)			7440-22-4	EPA 200.7
Sodium	mg/L	69	(15)			7440-23-5	EPA 200.7
Specific Conductance	µS/cm	2,200	(7)				SM 2510 B
Sulfate	mg/L	250	(7)			14808-79-8	EPA 300.1
TDS	mg/L	1,500	(7)				SM 2540 C
Zinc	mg/L	5	(6)			7440-66-6	EPA 200.7
Radioactivity							
Gross Alpha	pCi/L	15	(3)	3	(3)		SM 7110C
Organic Chemicals							
Atrazine	mg/L	0.001	(4)	0.0005	(5)	1912-24-9	EPA 508.1
Bentazon	mg/L	0.018	(4)	0.002	(5)	25057-89-0	EPA 515
Carbofuran	mg/L	0.018	(4)	0.005	(5)	1563-66-2	EPA 531.1-2
Chlordane	mg/L	0.0001	(4)	0.0001	(5)	57-74-9	EPA 505
Chlorpyrifos	µg/L	0.025	(14)			2921-88-2	EPA 8141
2, 4-D	mg/L	0.07	(4)	0.01	(5)	94-75-7	EPA 515.1-4
Diazinon	µg/L	0.16	(14)			333-41-5	EPA 507
Dibromochloropane (DBCP)	mg/L	0.0002	(4)	0.00001	(5)	96-12-8	EPA 504.1
Endrin	mg/L	0.002	(4)	0.0001	(5)	72-20-8	EPA 505
Ethylene Dibromide (EDB)	mg/L	0.00005	(4)	0.00002	(5)	206-93-4	EPA 504.1
Glyphosate	mg/L	0.7	(4)	0.025	(5)	1071-83-6	EPA 547
Heptachlor	mg/L	0.00001	(4)	0.00001	(5)	76-44-8	EPA 505
Heptachlor Epoxide	mg/L	0.00001	(4)	0.00001	(5)	1024-57-3	EPA 505
Lindane	mg/L	0.0002	(4)	0.0002	(5)	58-89-9	EPA 505
Methoxychlor	mg/L	0.03	(4)	0.01	(5)	72-43-5	EPA 505
Molinate	mg/L	0.02	(4)	0.002	(5)	2212-67-1	EPA 525.2
2, 4, 5-TP (Silvex)	mg/L	0.05	(4)	0.001	(5)	93-72-1	EPA 515.1-4
Simazine	mg/L	0.004	(4)	0.001	(5)	122-34-9	EPA 508.1
Thiobencarb	mg/L	0.07	(4)	0.001	(5)	28249-77-6	EPA 525.2
Toxaphene	mg/L	0.003	(4)	0.001	(5)	8001-35-2	EPA 505

Table 5. Water Quality Standards for Acceptance of Groundwater into the Upper Delta-Mendota Canal Headworks to Check 13 (O'Neill Forebay)

Sources:

Title 22. The Domestic Water Quality and Monitoring Regulations specified by the State of California Health and Safety Code (Sections 4010-4037), and Administrative Code (Sections 64401 et seq.), as amended.

(1) Title 22. Table 64431-A (mg/L)
(2) Title 22. Table 64432-A (mg/L)
(3) Title 22. Table 64442 (pCi/L)
(4) Title 22. Table 64444-A (mg/L)
(5) Title 22. Table 64445.1-A (mg/L)
(6) Title 22. Table 64449-A (mg/L)
(7) Title 22. Table 64449-B (mg/L)
(8) Title 22. Table 64678-A (mg/L)
(9) Title 22. Section 64678 (d)
(10) Title 22. Section 64678 (e)

California Regional Water Quality Control Board, Central Valley Region, Fourth Edition of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins.

(13) Basin Plan, Table III-1 (ug/L) (selenium in Grasslands water supply channels)

(14) Basin Plan, Table III-2A (ug/L) (chlorpyrifos & diazinon in San Joaquin River from Mendota to Vernalis)

Ayers, R. S. and D. W. Westcot, *Water Quality for Agriculture* , Food and Agriculture Organization of the United Nations - Irrigation and Drainage Paper No. 29, Rev. 1, Rome (1985).

(15) Ayers, Table 1 (mg/L) (sodium)

(16) Ayers, Table 21 (mg/L) (boron)

revised: 05 Feb 2010 SCC-107

Table 6. Water Quality Standards for Acceptance of Groundwater into the lower Delta-Mendota Canal Check 13 (O'Neill Forebay) To Check 21 (Mendota Pool)

Constituent	Units	Maximum Contaminant Level		CAS Registry Number	Recommended Analytical Method
Bicarbonate	mg/L	61	(5)	71-52-3	SM 2320 A
Boron	mg/L	0.7	(3)	7440-42-8	EPA 200.7
Calcium	mg/L	80	(5)	7440-70-2	EPA 200.5
Chloride	mg/L	40	(5)	189689-94-9	EPA 300.1
Chlorpyrifos	µg/L	0.025	(2)	2921-88-2	EPA 8141
Chromium, total	µg/L	50	(1)	7440-47-3	EPA 200.7
Diazinon	µg/L	0.16	(2)	333-41-5	EPA 507
Hardness	mg/L				calculated
Magnesium	mg/L	16	(5)	7439-95-4	EPA 200.5
Mercury	µg/L	2	(1)	7439-97-6	EPA 245.1
Molybdenum	µg/L	10	(3)	7439-98-7	EPA 200.7
Nickel	µg/L	100	(1)	7440-02-0	EPA 200.7
Nitrates (as NO3)	mg/L	45	(1)	7727-37-9	EPA 300.1
Nitrite (as nitrogen)	mg/L	1	(1)	14797-65-0	EPA 300.1
pH	units	5.0 - 7.0	(5)		EPA 150.1
Potassium	mg/L	4.5	(5)	7440-09-7	EPA 200.5
SAR		<2	(5)		calculated
Selenium	µg/L	2	(2)	7782-49-2	EPA 200.8
Sodium	mg/L	69	(3)	7440-23-5	EPA 200.7
Specific Conductance	µS/cm	1,230	(4)		SM 2510 B
Sulfate	mg/L	50	(5)	14808-79-8	EPA 300.1
Total Dissolved Solids	mg/L	800	(4)		SM 2540 C

(1) Title 22. The Domestic Water Quality and Monitoring Regulations specified by the State of California Health and Safety Code (Sections 4010-4037), and Administrative Code (Sections 64401 et seq.), as amended.

(2) California Regional Water Quality Control Board, Central Valley Region, Fourth Edition of the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins. Table III-2A

(3) Ayers, R. S. and D. W. Westcot, *Water Quality for Agriculture* , Food and Agriculture Organization of the United Nations - Irrigation and Drainage Paper No. 29, Rev. 1, Rome (1985).

(4) Second Amended Contract for Exchange of Waters, No I1r-1144, Article 9. Quality of Substitute Water.

(5) Spectrum Analytic, Inc. Guide to Interpreting Irrigation Water Analysis. Washington C.H., Ohio
http://www.spectrumanalytic.com/support/library/rf/A_Guide_to_Interpreting_Irrigation_Water_Analysis.htm

revised 11/23/2009 SCC-107

RECLAMATION
Managing Water in the West

Table 7. Approved Laboratory List for the Mid-Pacific Region Environmental Monitoring Branch (MP-157)

Basic Laboratory	**Address**	2218 Railroad Avenue Redding, CA 96001 USA
	Contact	Nathan Hawley, Melissa Hawley, Ricky Jensen
	P/F	(530) 243-7234 / (530) 243-7494
	Email	nhawley@basiclab.com (QAO), mhawley@basiclab.com (PM), jcady@basiclab.com (quotes), poilar@basiclab.com (sample custody), khawley@basiclab.com (sample custody)
	CC Info	nhawley@basiclab.com, jcady@basiclab.com (sample custody)
	Methods	*Approved only for inorganic parameters (metals, general chemistry)*
BioVir Analytical Laboratories	**Address**	685 Stone Road Unit 6 Benicia, CA 94510 USA
	Contact	Rick Danielson, Lab Director
	P/F	(707) 747-5906 / (707) 747-1751
	Email	red@biovir.com, csj@biovir.com, lb@biovir.com, QAO Jim Truscott jrt@biovir.com
	Methods	*Approved for all biological and pathogenic parameters*
Block Environmental Services	**Address**	2451 Estand Way Pleasant Hill, CA 94523 USA
	Contact	David Block
	P/F	(925) 682-7200 / (925) 686-0399
	Email	dblock@blockenviron.com
	Methods	*Approved for Toxicity Testing.*
California Laboratory Services	**Address**	3249 Fitzgerald Road Rancho Cordova, CA 95742
	Contact	Raymond Oslowski
	P/F	(916) 638-7301 / (916) 638-4510
	Email	rayo@californialab.com
	Methods	*Approved for Chromium VI*
Caltest Analytical Laboratory	**Address**	1885 North Kelly Road Napa, CA 94558
	Contact	Bill Svoboda, Project Manager x29
	P/F	(707) 258-4000 / (707) 226-1001
	Email	bsvoboda@caltestlab.com
	Methods	*Approved for all inorganic parameters and bioligical parameters*
Columbia Environmental Resource Center	**Address**	4200 New Haven Road Columbia, MO 65201 USA
	Contact	Tom May, Research Chemist
	P/F	(573) 876-1858 / (573) 876-1896
	Email	tmay@usgs.gov
	Methods	*Approved for mercury in biological tissue*
Data Chem Laboratories	**Address**	960 West LeVoy Drive Salt Lake City, UT 84123-2547 USA
	Contact	Bob DiRienzo, Kevin Griffiths-Project Manager, Rand Potter - Project Manager, asbestos
	P/F	(801) 266-7700 / (801) 268-9992
	Email	griffiths@datachem.com, Potter@datachem.com Invoicing: (Justin) pate@datachem.com
	Methods	*Approved for asbestos, metals, organochlorine pesticides and PCBs in solids*
Dept. of Fish & Game - WPCL	**Address**	2005 Nimbus Road Rancho Cordova, CA 95670 USA
	Contact	David B. Crane
	P/F	(916) 358-2858 / (916) 985-4301
	Email	dcrane@ospr.dfg.ca.gov
	Methods	*Approved only for metals analysis in tissue.*
Frontier Geosciences	**Address**	414 Pontius North Seattle, WA 98109 USA
	Contact	Shelly Fank - QA Officer, Matt Gomes-Project Manager
	P/F	(206) 622-6960 / (206) 622-6870
	Email	shellyf@frontiergeosciences.com, mattg@frontiergeosciences.com
	Methods	*in low level metals analysis.*

Fruit Growers Laboratory	**Address**	853 Corporation Street Santa Paula, CA 93060 USA
	Contact	David Terz, QA Director
	P/F	(805) 392-2024 / (805) 525-4172
	Email	davidt@fglinc.com
	Methods	*Approved for all inorganic and organic parameters in drinking water.*
Montgomery Watson/Harza Laboratories	**Address**	750 Royal Oaks Drive Ste. 100 Monrovia, CA 91016 USA
	Contact	Allen Glover (project manager), Bradley Cahoon (quotes)
	P/F	(916) 374-8030, 916-996-5929 (AG-cell) / (916) 374-8061
	Email	Allen.Glover@us.mwhglobal.com, Bradley.Cahoon@us.mwhglobal.com
	CC Info	cc. Sam on all communications to Allen. Samer.Momani@us.mwhglobal.com
	Methods	*Approved for all inorganic and organic parameters in drinking water*
Olson Biochemistry Laboratories	**Address**	SDSU: Box 2170, ACS Rm. 133 Brookings, SD 57007 USA
	Contact	Nancy Thiex, Laboratory Director
	P/F	(605) 688-5466 / (605) 688-6295
	Email	Nancy.Thiex@sdstate.edu
	CC Info	For re-analysis: contact Zelda McGinnis-Schlobohm and Nancy Anderson
		Zelda.Schobohm@SDSTATE.EDU, Nancy.Anderson@SDSTATE.EDU
		For analysis questions only: just CC. Nancy Anderson
	Methods	*Approved only for low level selenium analysis.*
Severn Trent Laboratories	**Address**	880 Riverside Parkway West Sacramento, CA 95605 USA
	Contact	Jeremy Sadler
	P/F	(916) 374-4381 / (916) 372-1059
	Email	jsadler@stl-inc.com
	Methods	*Approved for all inorganic parameters and hazardous waste organics* ***except for Ammonia as Nitrogen*** *.* *Ag analysis in sediment, when known quantity is present, request 6010B*
Sierra Foothill Laboratory, Inc.	**Address**	255 Scottsville Blvd, Jackson, CA 95642
	Contact	Sandy Nurse (Owner) or Dale Gimble (QA Officer)
	P/F	(209) 223-2800 / (209) 223-2747
	Email	sandy@sierralab.com, CC: dale@sierralab.com
	Methods	*Approved for all inorganic parameters, microbiological parameters, acute and chronic toxicity .*
Twining Laboratories, Inc.	**Address**	2527 Fresno Street Fresno, CA 93721 USA
	Contact	Jim Brownfield (QA Officer), Sample Control (for Bottle Orders)
	P/F	(559) 268-7021 / (559) 268-0740
	Email	JimB@twining.com cc. to JosephU@twining.com
	Methods	*Approved only for general chemistry and boron analysis.*
U.S. Geological Survey - Denver	**Address**	Denver Federal Center Building 20, MS 973 Denver, CO 80225 USA
	Contact	Stephen A. Wilson
	P/F	(303) 236-2454 / (303) 236-3200
	Email	swilson@usgs.gov
	Methods	*Approved only for inorganic parameters in soil .*
USBR Technical Service Center Denver Soils	**Address**	Denver Federal Center Building 67, D-8750 Denver, CO 80225-0007 USA
	Contact	Juli Fahy or Stan Conway
	P/F	(303) 445-2188 / (303) 445-6351
	Email	jfahy@do.usbr.gov
	Methods	*Approved only for general physical analysis in soils.*
Western Environmental Testing Laboratories	**Address**	475 East Greg Street # 119 Sparks, NV 89431 USA
	Contact	Ginger Peppard (Customer Service Manager), Andy Smith (Lab Director), Michelle Kramer
	P/F	(775) 355-0202 / (775) 355-0817
	Email	ginger@WETLaboratory.com, andy@WETLaboratory.com, michelle@WETLaboratory.com
	Methods	*Approved only for inorganic parameters (metals, general chemistry).*

San Luis & Delta-Mendota Water Authority
Delta-Mendota Canal

Table 8. Summary of Depth to Groundwater in Adjacent Wells (feet)
May 1995 - Dec 2009

Milepost	Max	Min	Average	Median	Count
12.37L	327.8	164.2	230.7	226.0	45
12.69L	244.8	207.5	226.1	225.0	45
12.75R	295.0	212.0	249.4	253.2	44
13.31L	275.8	210.0	229.9	226.2	44
14.26R	268.5	227.5	240.6	241.0	44
15.11R	264.0	200.0	238.4	238.8	45
21.25L	156.0	106.0	119.4	114.8	43
21.86L	130.0	89.6	107.6	107.9	45
22.77R	170.0	39.2	134.5	135.0	45
23.41L	254.0	141.0	190.7	188.0	45
30.43R	169.8	121.8	144.3	143.2	45
30.43L	155.0	102.0	124.5	124.1	45
31.60L	277.0	110.1	215.9	232.0	45
33.71L	198.6	130.9	166.8	168.0	45
35.73R	179.0	146.8	159.1	159.0	45
36.01L	290.0	137.2	201.3	174.0	43
36.80L	204.0	111.0	152.2	146.0	44
37.10L	277.0	158.0	193.3	189.9	44
37.32L	200.0	150.8	165.4	161.4	44
37.58L	170.0	127.8	146.2	141.2	44
45.78R	121.0	83.0	98.0	95.3	44
48.97L	130.0	80.8	97.3	95.0	44
51.66L	141.2	86.4	108.5	106.0	44
58.28L	63.0	27.0	41.5	39.8	43
60.06R	95.0	37.6	64.2	60.2	43
66.71L	49.8	19.8	34.6	33.0	43
78.31L	49.3	21.9	28.5	27.0	52
79.13R	111.8	59.4	84.5	88.2	52
79.60L	83.2	54.5	65.0	62.3	52
80.03L	80.0	16.0	34.5	34.0	52
80.03R	143.5	143.5	143.5	143.5	1
80.62R	100.2	47.8	60.6	58.5	52
80.62L	69.0	19.4	43.1	43.0	52
83.08-R	64.9	37.6	44.9	42.7	27
83.67-L	71.6	12.0	24.2	21.9	27
90.18R	201.3	103.9	136.8	130.0	52
90.19L1	218.5	98.9	141.8	133.2	52
90.19L2	190.0	72.0	131.6	123.4	52

San Luis & Delta-Mendota Water Authority
Delta-Mendota Canal

Table 8. Summary of Depth to Groundwater in Adjacent Wells (feet)
May 1995 - Dec 2009

Milepost	Max	Min	Average	Median	Count
90.39R	212.0	105.0	136.0	129.2	52
90.60L	187.8	28.7	133.0	129.2	52
90.61R	198.0	104.0	135.0	127.9	52
90.91L	285.9	93.2	141.7	134.6	52
91.15L	287.7	97.4	134.8	128.0	52
91.36L	217.0	16.8	116.6	121.1	52
91.57R	222.2	91.8	132.0	126.5	52
91.68R	219.6	99.2	136.8	136.1	52
91.77R	172.2	96.0	127.1	124.2	52
91.80L	195.2	93.1	130.1	124.3	52
92.00R	172.6	109.0	137.7	131.2	52
92.14L	215.1	98.8	140.2	134.7	52
92.20R	220.0	95.8	137.3	135.3	52
92.72L	218.3	100.2	140.2	131.9	52
93.20L	296.1	102.2	135.3	129.9	52
93.27R	228.4	115.0	152.7	148.0	51
93.27L	208.5	100.8	140.1	133.5	52
94.26L	228.1	99.7	135.9	131.5	52
95.62L	213.4	99.6	138.9	127.4	52
97.28L	131.5	34.0	60.6	50.0	52
98.74L	114.2	39.2	53.8	45.6	52
99.24L	96.0	31.5	56.1	51.2	52
99.82L	181.8	19.5	57.0	50.6	52
100.24L	136.6	28.1	52.6	45.6	52
100.65L	131.2	36.5	62.2	55.2	52
100.85L	98.3	39.0	56.2	49.6	51
101.27L	120.5	37.4	58.4	49.0	51
102.04R	130.0	38.0	60.2	50.9	51
106.20R	134.5	60.7	84.8	81.9	51
113.72L	29.2	13.2	21.6	21.6	51
115.32R	82.9	18.5	31.0	31.6	51
115.62L	42.0	12.2	25.5	24.4	50
115.84R	39.2	14.9	25.1	23.6	51
116.40L1	77.0	14.2	30.4	28.0	51
116.40L2	74.0	11.3	29.8	23.7	51

Appendix 1. 2010 Letter from Exchange Contractors

SAN JOAQUIN RIVER EXCHANGE CONTRACTORS WATER AUTHORITY
CCID • CCC
FCWD • SLCC

Consisting of 240,000 acres on the Westside of the San Joaquin Valley

JAMES E. O'BANION
Chairman

ROY CATANIA
Vice Chairman

STEVE CHEDESTER
Executive Director

LARRY FREEMAN
Water Resources Specialist

JOANN TOSCANO
Administrative Assistant

MINASIAN, SPRUANCE, MEITH, SOARES & SEXTON LLP
Legal Counsel

CENTRAL CALIFORNIA IRRIGATION DISTRICT

James E. O'Banion
President

Christopher White
General Manager

SAN LUIS CANAL COMPANY

James L. Nickel
President

Chase Hurley
General Manager

FIREBAUGH CANAL WATER DISTRICT

Mike Stearns
President

Jeff Bryant
General Manager

COLUMBIA CANAL COMPANY

Roy Catania
President

Randy Houk
General Manager

P.O. Box 2115
541 H Street
Los Banos, CA 93635
(209) 827-8616
Fax (209) 827-9703
e-mail: jtoscano@sjrecwa.net
Website: www.sjrecwa.net

January 15, 2010

VIA EMAIL & U.S. MAIL

Mr. Michael Jackson
U.S. Bureau of Reclamation
1243 N Street
Fresno, CA 93721-1813

Ms. Frances Mizuno
San Luis & Delta-Mendota Water Authority
Post Office Box 2157
Los Banos, CA 93635

RE: ***2010 DMC Pumping***

Dear Michael and Frances:

This letter is to confirm the San Joaquin River Exchange Contractors Water Authority's (Exchange Contractors) approval of your request to continue the DMC pumping program in 2010. As a result of subsidence effects being determined in 2008, this year's program must continue to include that no pumping will be allowed in Management Areas 2 and 3.

As you know, a joint groundwater study between the Central California Irrigation District, the City of Los Banos and the United States Bureau of Reclamation is currently being conducted in the Los Banos aquifer subarea due to significant groundwater concerns. The study and its recommendations are anticipated to be completed in March 2010. Due to the regulatory pumping restrictions that are being implemented on the Jones Pumping Plant, we can appreciate the SLDMWA's need to begin the environmental review process for the 2010 DMC Pumping Program; however, we must reserve the right to amend this approval letter pending the outcome of the joint groundwater study.

The Exchange Contractors' Board approval for this pumping program is based upon the conditions set forth below:

1. Any well that is proposed to pump into the lower DMC must obtain a current water quality analysis. The analysis shall consist of Ag Suitability and selenium, plus any other constituents the U.S. Bureau of Reclamation (USBR) may require. (Wells may be pumped for 24

hours in order to get the initial sample for water quality testing.) These tests will be conducted on a monthly basis for the duration of the pumping period. From our perspective, pumping may begin once we have received copies of current lab test results for salinity and selenium, recognizing the other constituents may take longer to obtain the lab results.

2. Only wells that test at 1,500 ppm TDS or less at the well head will be allowed.

3. Only wells that test at 2 ppb selenium or less at the well head will be allowed.

4. The calculated degradation caused by the lower DMC wells shall not exceed 30 ppm. (The model developed by USBR during the 2008 and 2009 pumping program shall be used and USBR shall provide at least weekly updates of the reports to the Exchange Contractors.)

5. At any time, the wells in the lower DMC will be shut off if the measured water quality at Check 20 on the DMC exceeds 450 ppm TDS in a single day. The wells may resume pumping after the average water exceedence no longer exists for 3 days. Wells with water quality at the well head of 450 TDS or less would be allowed to continue to pump and would not be subject to this restriction.

6. The water would be credited to the receiving district as a whole, not for specific growers.

7. The wells will only run through February 28, 2011.

If you agree with the program as outlined, and before any additional lower DMC pumping commences, we request that each of your agencies confirm in writing to the program described above. Please contact us if you have any questions regarding this matter.

Sincerely,

Steve Chedester

cc: San Joaquin River Exchange Contractors Members
Paul Minasian, Esq.

Appendix 2. Recommended Well Summary Form

2010 DMC Pump-in Program
Summary Sheet

District:	
Well Operator:	
Well ID	
Well Location	

Groundwater elevation

Depth to groundwater	
Date of measurement	

DMC Milepost	

Water Quality Analysis

Date of sample	
Lab	
Sample ID:	